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RESEARCH ARTICLE

Phenology and diurnal behavior of common shelduck *Tadorna tadorna* at Sebkhet Bazer (El-Eulma, Nouth-East of Hauts Plateaux, Algeria)

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Abstract

This work aims to study phenology and daytime budget of common shelduck *Tadorna tadorna* (Anatidae) for two wintering seasons (2017/2018, 2018/2019) at Sebkhet Bazer (El-Eulma) North-East of Algeria from September to March. The obtained results show that common shelduck has the status of a wintering species. It was observed presently in the site during the study period. Common shelduck numbers begin to increase from the first decade of September to reach the maximums between late December and early January, where we had recorded the peaks of abundance 840 for the first season and 930 for the second. During our monitoring, budget time results showed that feeding is the dominant activity (surface water feeding, feeding on banks, and feeding by tipping), which take a ratio of more than 68%, the second activity is swimming with 18.71%, followed by preening which holds 9.14%, sleeping activity with a ratio of 2.38%, flight take the five range with a ratio of 0.82%. Finally, courtship and agonistic behavior recorded the lowest ratio on all budget time – 0.42% and 0.38% respectively. We can conclude that Sebkhet Bazer is a diurnal grazing ground for this Anatidae species.

Keywords

Common shelduck, *Tadorna tadorna*, phenology, daytime budget, Sebkhet Bazer

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Introduction

The common shelduck *Tadorna tadorna* Linné 1758 breeds in temperate Eurosiberia, and most of populations migrate to subtropical areas in winter (NARBA, 2011). This species is widely spread in the Palaearctic, from Ireland and Spain on the west to China on the east. In Europe, it is mainly present in northern countries, on the Channel coast, the Atlantic Ocean, and the North Sea. These numbers are estimated at only 41,000–57,000 pairs, including 10,900 in Great Britain (Kershaw &Cranswick, 2003), 8,000–12,000 in Sweden, 6,000–9,000 in the Netherlands, and 4,000–5,000 in Germany. The species is not currently threatened after a significant phase of recolonization that began in the 1960s (Wetlands International, 2004). The North African region may also be an important wintering area for the migratory Northwest European population (Altman, 1974; Baldassare et al., 1988).

Algerian population of common shelduck is a part of the dispersed Mediterranean/Black Sea population, which is scattered across both sides of the Mediterranean Sea (Cramp & Simons, 1977; Isenmann & Moali, 2000; Wetland International, 2002). Heim de Balsac & Mayaud (1962) listed the shelduck as a common species within Algeria with at least two known breeding sites: Lac Fetzara and Lac Halloula. In 1971 total Algerian population was about 1500–5100 shelducks (Johnson & Hafner 1972) in the wetland complex of Oum El Bouaghi, a region also known as the "Constantinois". Numbers were subsequently estimated by Walmsley (1986, 1987) to vary between 1,000 and 7,500 with a mean value of 4,000. A mid-winter count of 3,160 birds in January 1994 (Rose, 1995).

However, Boulakhsaim et al. (2006) estimated that numbers of shelduck recorded were far higher than previously noted for the whole of Algeria, with up to 68,000 individuals counted in January 2005.

Due to limited data on the phenology and diurnal behavior of common shelduck in Algeria and in order to focus on the ecological role of particular protected wetlands in the maintenance of waterbird populations, it is essential to report on the ecology (abundance, spatial and temporal distribution, and diurnal time budget monitoring) of the common shelduck *Tadorna tadorna* in such wetland, here, the Sebkhet Bazer. The main interest of this research is to understand the ecological requirements of common shelduck and threats to these birds to draw attention to the need for the conservation and management of wetlands for the protection and preservation of breeding and wintering Anatidae.

Study area

Sebkhet Bazer is a salt lake located 9 km in the south of El-Eulma city, limited at the west by Djebel Braou (1263 m a.s.l.), in the north – by Merdjet Ech-chtout (920 m a.s.l.), in the south – by Koudiat Gueltet Ed Debba lying at an altitude of 972 m, and in the east – by Mechtet Nouasser (922 m a.s.l.). Geographically the site is located between 36°00′ and 36°05′N latitude and 5°37′E at 5°45′E longitude (Fig. 1). It co-

vers an area of 4379 ha and located between 910 and 917 m a.s.l. The wetland is a natural permanent, closed, and salty depression; is located in the highest altitude of Setif region. It sinks into a generally flat relief where the Oued El-Melah, supplied by wastewater (domestic and industrial) from El-Eulma city and the El-Melah village, ensures the hydromorphy of the sabkha in the summer season. In winter and rainy years, the water level can reach 1.5 m. Sebkhet Bazer was classified as a Ramsar site in 2004 by Criterion 2 and Criterion 6. The site hosts nine species protected at the national level by the decree of August 20, 1995: common shelduck *Tadorna tadorna*, ruddy shelduck *Tadorna ferruginea*, greater flamingo *Phoenicopterus roseus*, greylag goose *Anser anser*, harrier reeds *Circus aeruginosus*, common crane *Grus grus*, white stilt *Himantopus himantopus*, white stork *Ciconia ciconia*, and avocet *Recurvirostra avosetta*. Sebkhet Bazer is a wetland of international importance for wintering the greater flamingo, especially common shelduck. The site has hosted more than 1% of the biogeographic population of common shelduck during the years 1985, 1986, 1988, 1989, 1992, 1998, 2001, and 2004. The flamingo numbers was above 1% during 1986, 1987, and 1992.

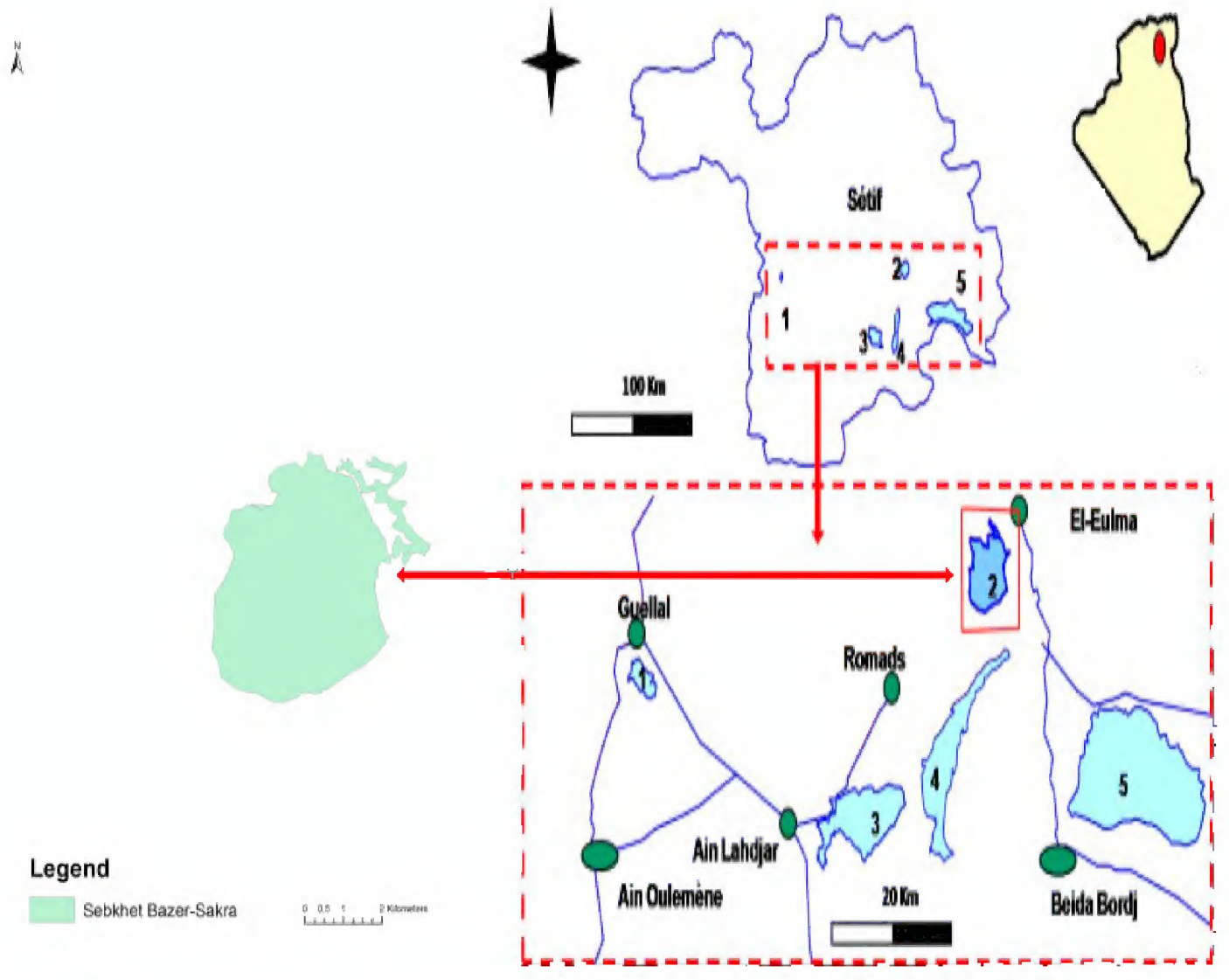

Figure 1. Geographic location of Sebkhet Bazer (El-Eulma).

Sampling

The phenology and diurnal behavior of common shelduck *Tadorna tadorna* were studied at Sebkhet Bazer (El-Eulma, Setif) for two consecutive years, from August 2017 to July 2019. Birds were counted thrice per month. Individual counting is possible when the common shelduck group is near to observation points (within 200 m) and counts less than 200 individuals, otherwise, visual estimation of the group can be made (Blondel, 1975; Houhamdi, 2002). During the same campaign, regular monitoring of diurnal activities rhythms of common shelduck was realized. It was organized every hour from 8 AM to 5 PM during all the observation time on 80 to 100% of the individuals present in the site using the instantaneous scan sampling method, which is very suitable for this type of terrain (large, open, and little disturbed) (Altmann, 1974), corrected and improved by Baldassare (1988) and Losito (1989). Thus, we carried out once a week, from August 2007 to July 2020, scans of the majority of individuals whose behaviors were easy to observe (Houhamdi&Samraoui, 2001, 2003, 2008; Amorabda et al., 2015; Merzoug et al., 2015; Charchar et al., 2019). The activities measured are water surface feeding, feeding by tipping, feeding on the banks, preening, sleeping, swimming, flying, agonistic behavior, and courtship. The data were then exploited using a multivariate Principal Component Analysis (with Xl-stat software) to describe the relationships between the different activities.

Results

Evolution of population (bird number)

Common shelduck exhibited a similar abundance pattern for 2017/2018 and 2018/2019 within the study area. The species was found present all-around the wintering season at the wetland from September to March, with a population ranging from 61 to 840 individuals for the first wintering season and from 57 to 930 individuals for the second wintering season. The abundance of common shelduck begins to increase from the first decade of September. The high numbers of common shelduck are mainly recorded between late December and early January, before decreasing progressively. They were confirming the results obtained in previous studies in the wetland of Haux Plataux (Boulakhsaim et al., 2006). Fewer than 100 birds were presented at the end of wintering seasons. During the study period, numbers of common shelduck peaked at 840 birds in the first decade of January 2018 and 930 for the last decade of December 2018 (Fig. 2). This species is often solitary. It was mainly observed grouped into the small population and rarely associated with other bird species, occupy the muddy banks and the edges of the lake, but during the mid-days, they cross the lake without stopping. Thus, compared to other wet-

lands in the Hauts Plateaux north-easterner of Algeria (Bellagoune et al., 2015), the common shelduck, a sensitive species to the water depth variation, do not change their number according to water depth variation in this wetland.

Figure 2. Evolution of the abundance of common shelduck *Tadorna tadornaat* at Sebkhe Bazer (El-Eulma) in 2017/2018 (blue) and 2018/2019 (red). 01 – first decade of the month, 02 – second decade of the month. 03 – third decade of the month.

Study of diurnal behavior

After two wintering seasons of monitoring from 8 AM to 5 PM of diurnal behavior of common shelduck at Sebkhet Bazer (El-Eulma), the obtained results showed that the budget time is dominated by feeding activity (surface water feeding, feeding on banks, and feeding by tipping), which take more than 68%. The second diurnal activity is swimming (18.71%), followed by preening (9,14%), sleeping (2,38%), and flying (0,82%). Finally, courtship and agonistic behavior take the lowest percentage of budget time – 0.42 and 0.38% respectively (Fig. 3).

Feeding is an essential activity for all Anatidae species (Tamisier & Dehorter 1999; Houhamdi, 2002; Houhamdi & Samraoui, 2002; Boulekhssaim et al., 2006; Charchar et al., 2016). The highest rates of feeding activity are recorded during the cold period between mid-December and early February (80%), followed by a decrease of this activity at the end of wintering seasons – 60% of diurnal time. At Sebkhet Bazer (El-Eulma), common shelduck was foraging in different ways, either by filtering the water in deep regions(0.8-1.5 m), walking on the banks or by feeding by tipping (Fig. 4). Surface water feeding dominated other foraging methods at Sebkhet Bazer, with an average of 40% of the time allocated to feeding activity,

compared to 32% for feeding by tipping and 28% for feeding on the banks. Surface water feeding increases progressively to reach the highest rates at the end of January, then a decrease was observed until the end of wintering season (Fig. 5a). Unlike surface water feeding, an inverse curve was displayed by feeding on the banks, which recorded an increase from late January until the end of wintering season (Fig. 5c). Marked fluctuations in the time allocated to feeding by tipping were recorded (Fig. 5b). Its diet depends mainly on crustaceans such as *Hydrobia* and *Artemia* (Peterson, 1982; Chadenas, 2003). These invertebrates are also well represented in the diet of shelducks wintering in Brittany (Gelinaud, 1997), but Chenopodiaceae or Zosteraceae seeds can locally constitute a vital, even essential, resource. The species also probably exploits the diatom biofilm that develops on the surface of the sediment (Gelinaud, 1997).

Swimming is often accompanied by other activities such as feeding, sleeping, and courtship. But it occurs mainly when the bird was changing location and tried to avoid the drift induced by wind and waves where it manifests in a coordinated manner (Tamisier & Dehorter, 1999). The maximum rate recorded of this activity is around 23% earlier September. Monitoring the evolution of the graph shows us a gradual decrease over time between September and January, then it returns to the increase again between the end of January until the end of March. Rates appear to increase towards the end of the wintering season. Overall, common shelduck exhibits a general rate of swimming estimated at 18, 71% (Fig. 5d).

At Sebkhet Bazer, the common shelduck's preening activity, and maintenance of the plumage were observed mainly in the water and rarely on the banks, and it took an average of around 9.14% of the time budget. (Fig. 3). The graph of this activity shows remarkable fluctuation during the study period, with increases and decreases observed throughout our monitoring. The maximum recorded for this activity is 11% in mid-October (Fig. 5e). It should be noted that during the days, the highest rates were observed during the early mornings. These rates gradually decrease during the days.

Conversely, other Anatidae, where sleeping is an essential activity (Tamisier, Dehorter 1999; Houhamdi, 2001, 2003, 2008; Houhamdi et al., 2008, 2009; Merzoug et al., 2014, Charchar et al. 2016; Bouchaala et al. 2017; Charchar et al. 2019), this activity occupying the fifth position in a diurnal budget time of common shelduck at Sebkhet Bazer with a rate of 2,38%. The evolution curve of this activity over time displayed several fluctuations and exhibiting several peaks (Fig. 5f), the maximums were recorded during December and February (4%). In general, this activity is observed preferentially in water, mostly during the mid-day, and shows decreasing rates during the day.

Flying was rarely observed (0,82%) during the wintering period and only following a disturbance caused by wandering herders or birds of prey.

Courtship occupied small mean values in budget time during the wintering seasons (0.42%), the highest values recorded at the end of March were 2%. We had started to record this activity mainly towards late January until the end of the wintering seasons.

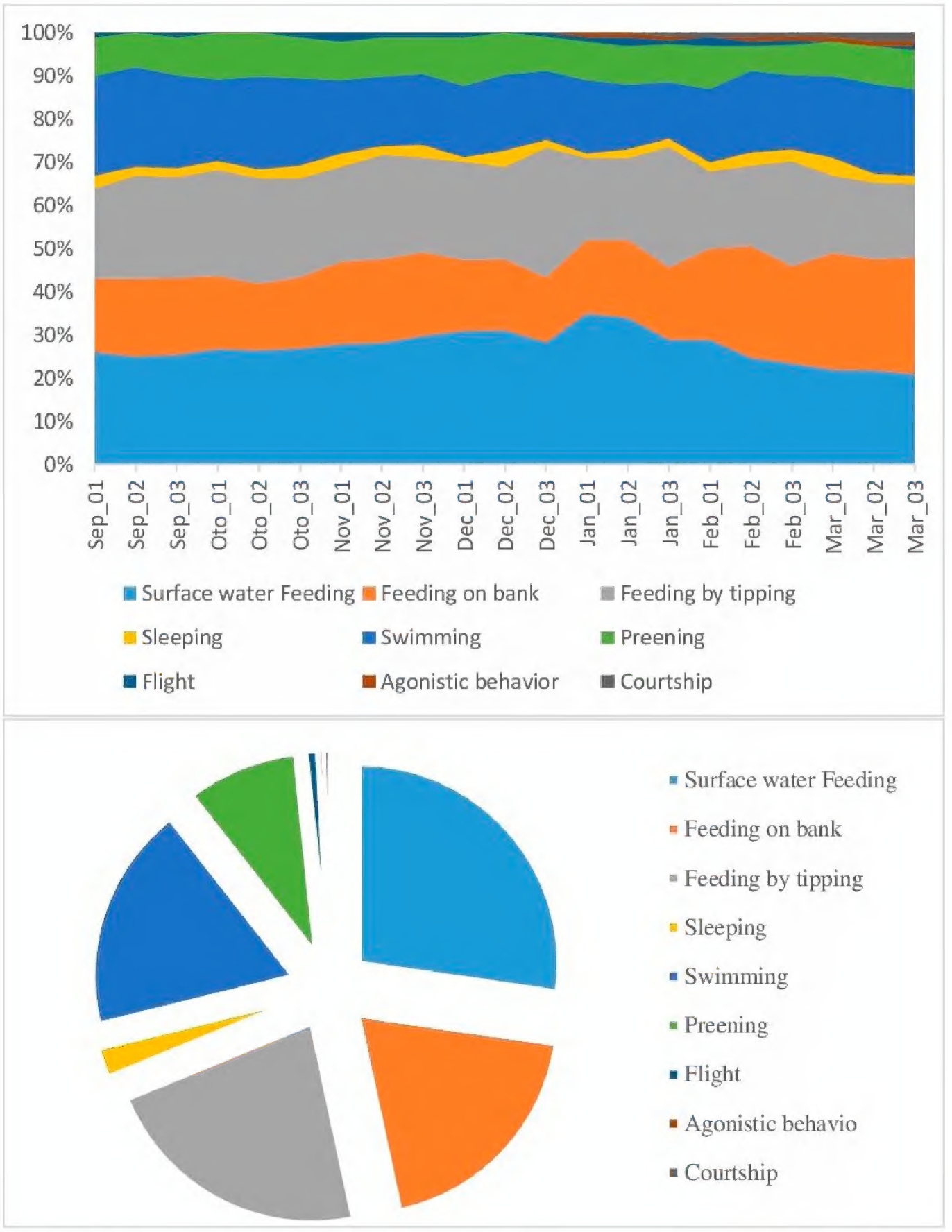

Figure 3. Balance of diurnal rhythms activities of common shelduck *Tadorna tadorna* at Sebkhet Bazer (El-Eulma) in 2017/2018 and 2018/2019.

A similar pattern was seen for agonistic behavior. This activity was also rarely observed, first time in earlier January. It increased gradually to reach a maximum at the end of March. This burst of aggressiveness coincided with the start of the breeding period.

This study on the daytime activities of common shelduck at Sebkhet Bazer confirmed the results reported at the wetlands of Hauts Plateaux, where common shelduck used an essential part of its daytime budget to feeding activity. Similar patterns of diurnal activity is explained by similarities in local conditions, including food availability and distribution, abiotic factors, such as water temperature (thermoregulation), and biotic factors, such as predation, intra-, and interspecific competition.

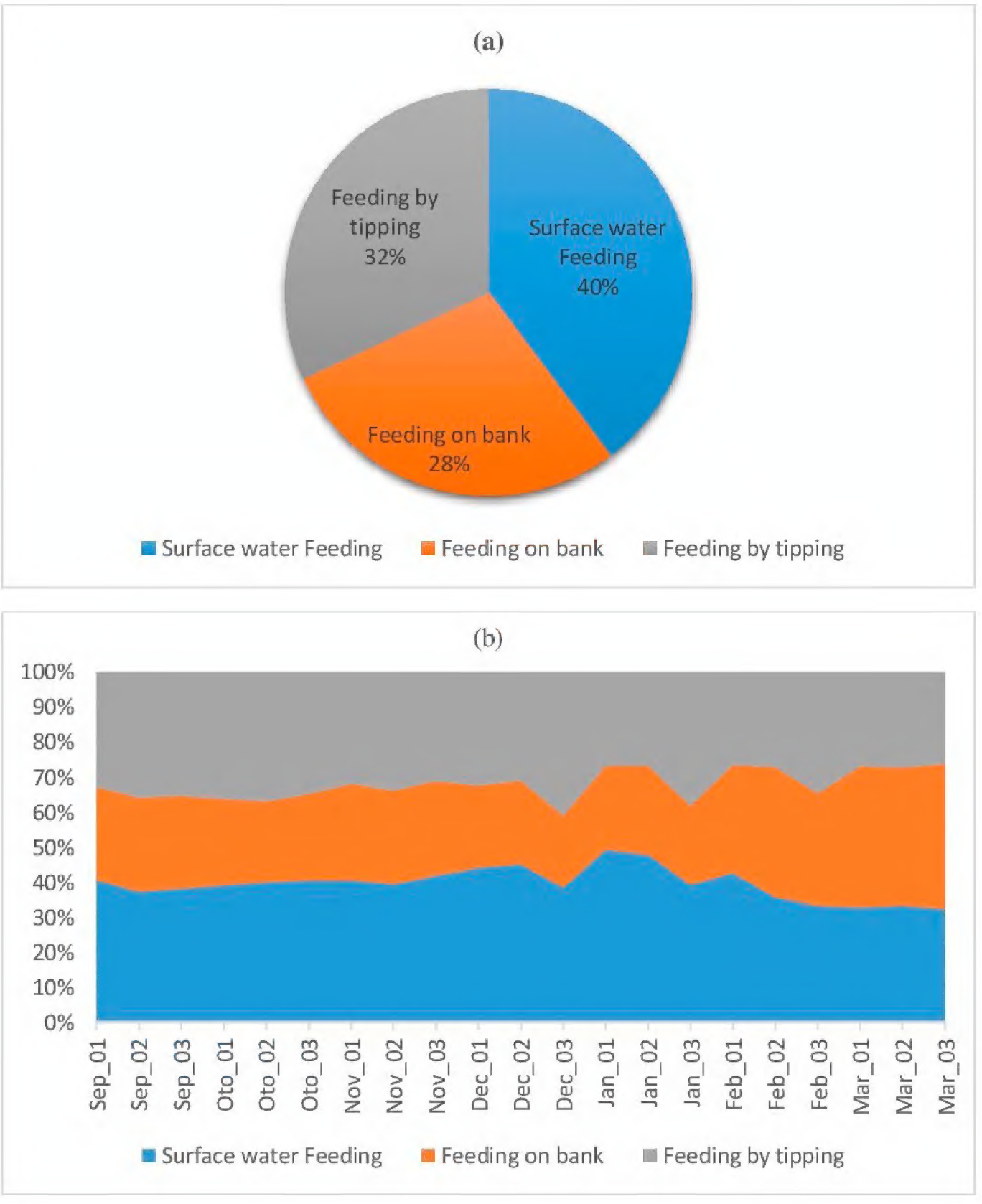

Figure 4. Foraging methods of common shelduck *Tadorna tadorna* at Sebkhet Bazer (El-Eulma) in 2017/2018 and 2018/2019.

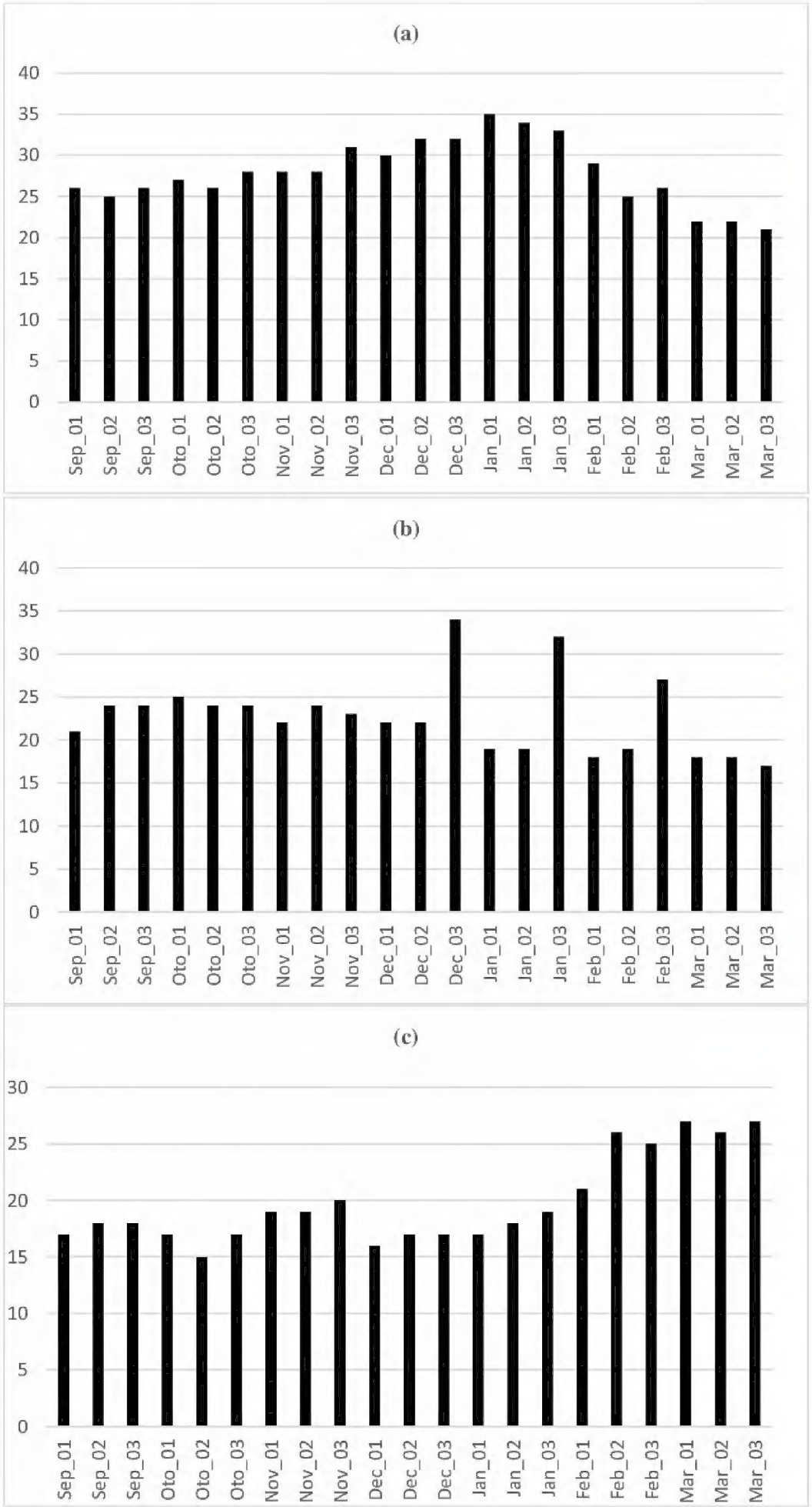

Figure 5. Evolution of diurnal activities patterns of common shelduck *Tadorna tadorna* at Sebkhet Bazer (El-Eulma) in 2017/2018 and 2018/2019: **a** – surface water feeding; **b** – feeding by tipping; **c** – feeding on banks; **d** – swimming; **e** – preening; **f** – sleeping, **g** – flight; **h** – courtship; **i** – agnostic (continued on the next page).

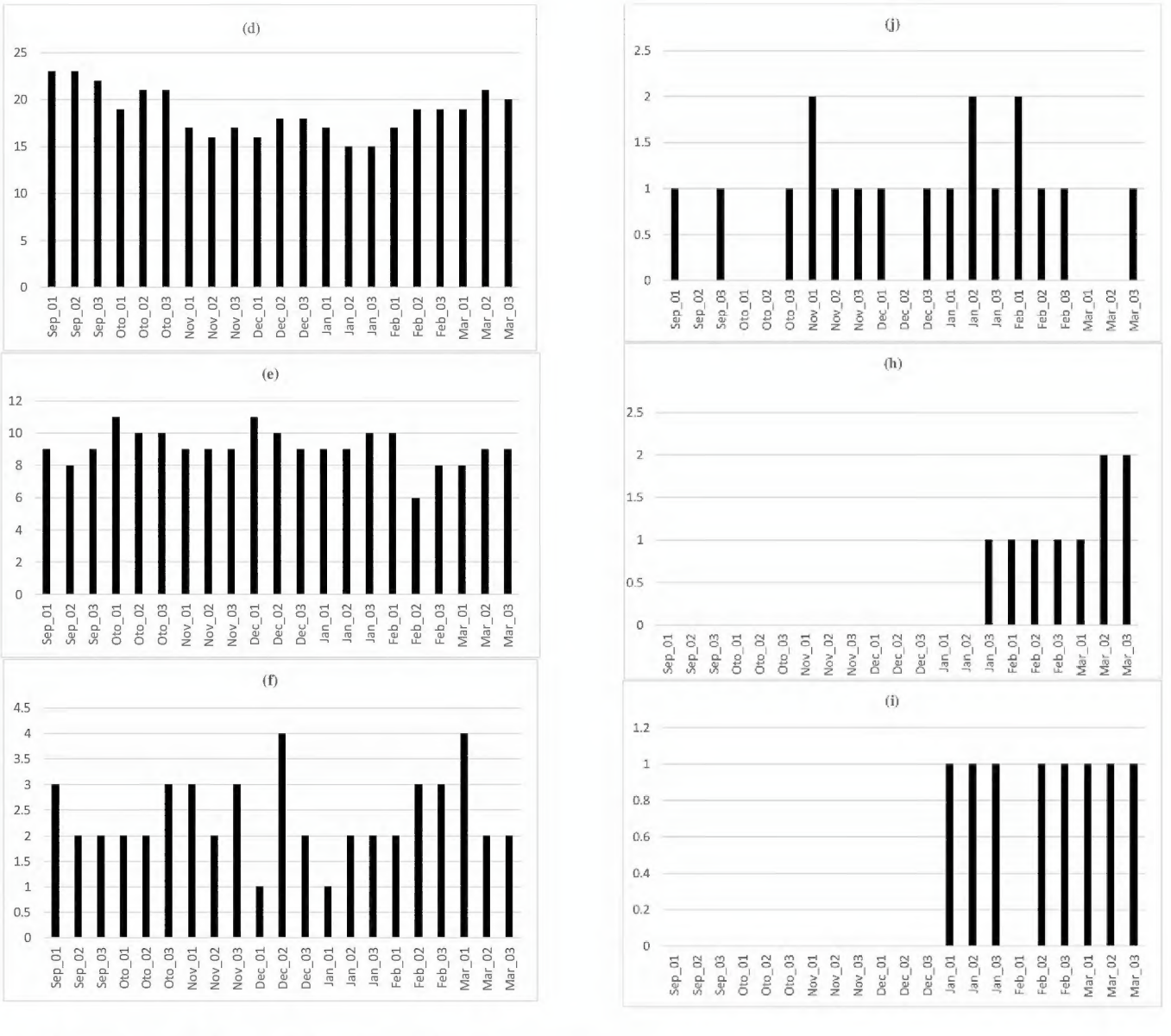

Figure 5. Continued from the previous page.

Multivariate statistical treatment of diurnal activity rhythms

The correspondence analysis represents 61.04% of the information (Fig. 6), shows that the diurnal behavior of the common shelduck at Sebkhet Bazer (El-Eulma) wetland is subdivided into two essential groups characterizing two parts of wintering seasons.

The first group is represented by the activities of the dominant, which are surface water feeding and feeding by tipping, recorded with high rates during our monitoring, it generally characterizes the period between October and January (Fig. 6). During this time, the lake's water level rises as a result of the rain, and the birds have spent there most of their time eating in the water. Unlike the results obtained in subsequent studies carried on ruddy shelduck *Tadorna ferruginea* (Nouidjem, 2014; Khaffou, 2014; Bounab, 2018) confirm the sensitivity of this species to deep water. Preening activity is also represented in this group characterizes the new arrivals to the Sebkhet that have to change their damaged feathers after a long migration. Common shelduck was observed preening its feather on the shores of the lake.

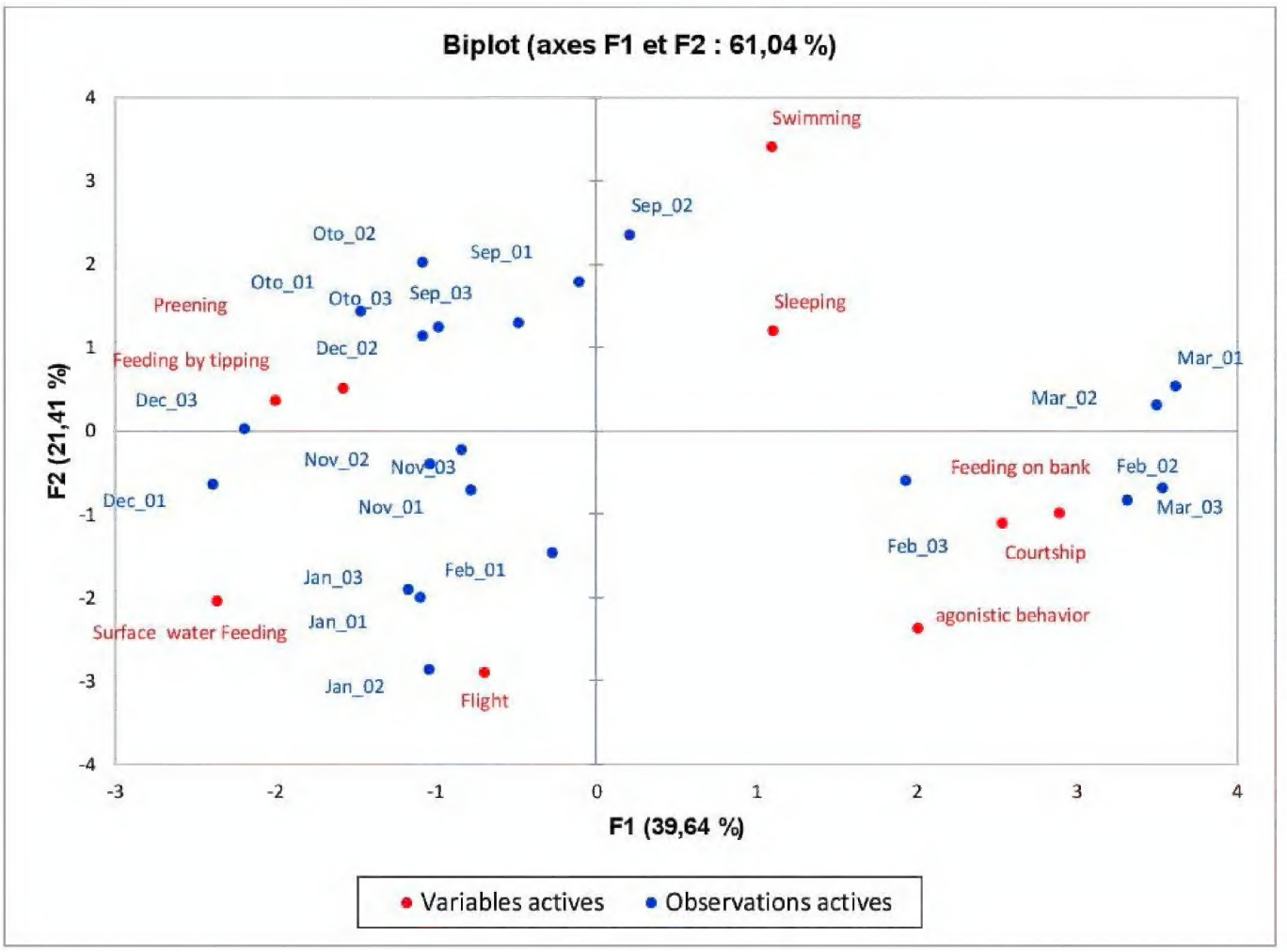

Figure 6. Analysis (CA) factorial plan 1×2 of diurnal rhythms of activities of common shelduck *Tadorna tadorna* at Sebkhet Bazer (El-Eulma) during 2017/2018.

The second group is represented by such activities as feeding on the banks, courtship, and antagonistic behavior. The dominating of this behavior is generally common at the end of wintering seasons and the beginning of breeding seasons in February and March, when we observe the formation of couples, which spend most of their time feeding on the banks, especially during the afternoon by filtering the mud cream, that is to say, the surface layer of loose sediments. The birds were also observed preening theirs feather on the lake shores.

The Principal Component Analysis also shows that the swimming activity is recorded all around the wintering seasons with more or less stable rates (Fig. 6).

Conclusion

Due to few studies on the phenology and diurnal behavior of the common shelduck in Algeria, this study highlights this species' ecology at the Ramsar site. Sebkhet Bazer (El-Eulma) represents a very suitable habitat for daytime grazing for common Shelduck. It plays the role of a daytime sheathing ground, where the food activity takes up a significant part of the daytime budget. This diurnal fattening is noted in the early mornings on the lake's shores. On daybreaks, common shelduck *Tador-*

na tadorna enter the water and continues to feed by either tilting or dipping their head or just their beak. However, these results, collected over the two consecutive wintering seasons, evaluate new information regarding the diurnal behavior of this Anatidae. Moreover, we believe that more studies should be carried out to better understand the status and requirements of this species. It would be preferable to determine the ecological role and the functioning of this continental aquatic ecosystem; a synthesis over several years (wintering and reproduction) and bringing together the work on all species of Anatidae is necessary to identify the notion of transfer and/or restoration of this wetland.

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References

Altmann J (1974) Observational study of behavior: Sampling methods. Behaviour, 49 (3–4): 227-267. https://doi.org/10.1163/156853974X00534

Amor Abda W, Merzoug S, Belhamra M, Houhamdi M (2015) Phenology and diurnal behavior of the Northern Shoveler Anas clypeata in the Guerbes- Sanhadja wetland complex (north-eastern Algeria). Zoology and Ecology 1: 19-25. https://doi.org/10.1080/21658005.2014.994361

Baldassare GA, Paulus SL, Tamisier A, Titman RD (1988) Workshop summary: Techniques for timing activity of wintering waterfowl. In: Weller MW (ed.) Waterfowl in Winter. Minnesota Press, Minneapolis, 23-26.

Bellagoune S, Maazi MC, Saheb M, Bara M, Bouslama Z, Houhamdi M (2015) Ecology of wintering of common Shelduck *Tadorna tadorna* in Sebkhet Djendli (Batna, Hauts plateaux, East of Algeria). The Free Library (February, 1).

Blondel J (1975) Analysis of populations of water birds. Element of ecological diagnosis. I: Progressive sampling method frequency (EFP). Rev. Ecol-Terre Vie, 29: 533-589.

Bouchaala L, Charchar N, Boukhemza M, Houhamdi M (2017) Behavior and phenology of Wigeon Anas penelope in the Garaet of Hadj-Tahar (Skikda, Northeast of Algeria). Journal of entomology and zoology studies, 5(2): 361-364.

Boulkhssaim M, Houhamdi M, Samraoui B (2006) Status and diurnal behavior of the Shelduck Tadorna tadorna in the Hauts Plateaux, northeast Algeria. Wildfowl, 56: 65-78.

Bounab C (2018) Phénologie et structure des Tadornes (Tadorne de Belon et Tadorne casarca) dans le Chott El-Hodna (wilaya de M'sila, Algérie). Thèse de doctorat, Université Djillali Liabes de Sidi Bel abbes, Algeria. [In French]

Chadenas C (2003) L'homme et l'oiseau sur les littoraux d'Europe occidentale : Appropriation de l'espace et enjeux territoriaux : vers une gestion durable. Thèse Doctorat. Université de Nantes, France. [In French]

Charchar N, Bouchaâla L, Houhamdi M (2019) Phenology and diurnal behavior of marbled duck Marmaronetta angustirostris in the eco-complex of wetlands of Guerbes Sahhadja North-east of Algeria. Ecologia Mediterranea, 45 (2): 35-43. http://dx.doi.org/10.3406/ecmed.2019.2087

Charchar N, Boucaaala L, Belhamra M, Houhamdi M (2016) Diurnal time budget of wintering Teal *Anascrecca crecca* (Anatidae) at Garaet Hadj-Tahar (Skikda) Northeast Algeria. Journal of entomology and zoology studies, 5(1): 540-545.

Cramp S, Simmons KEL, Fergusson-Lees IJ, Gillmor R (Eds) (1986) Handbook of the birds of Europe, the Middle East and North Africa.Vol. 1: Ostrich to ducks. Oxford, London, New York, Oxford University Press, 722.

Houhamdi M, Samrauoi B (2001) Diurnal behavior of common teal *Anas crecca crecca* at lac des Oiseaux, northest Algeria. Ardeola 55 (1): 59-69.

Houhamdi M (2002) Ecology of avian populations of Lac des Oiseaux (oriental Numidia). Doctoral thesis. Badji Mokhtar-Annaba University, (Algeria).

Houhamdi M, Samraoui B (2003) Diurnal behavior of wintering Wigeon *Anas penelope* at Lac des Oiseaux, Northeast Algeria. Wildfowl, 54: 51-62.

Houhamdi M, Samraoui B (2002) Occupation spatio-temporelle par l'avifaune aquatique du Lac des Oiseaux (Algérie) / Spatio-temporal distribution of water birds at the Lac des oiseaux (North East Algeria). Alauda (Dijon), 70 (2): 301-310. [In French]

Houhamdi M, Samraoui B (2008) Diurnal and nocturnal behaviour of ferruginous duck *Aythya nyroca* at Lac des Oiseaux, Northern Algeria. Ardeola, 55 (1): 59-69.

Houhamdi M, Maazi MC, Seddik S, Bouaguel L, Bougoudjil S, Saheb M (2009) Statut et écologie de l'Érismature à tête blanche (*Oxyura leucocephala*) dans les hauts plateaux de l'est de l'Algérie / Status and ecology of the White-headed duck *Oxyura leucocephala* in the wetlands of the high plains of East Algeria. Aves, 46 (1): 9-19. [In French with English summary]

Isenmann P, Moali A (2000) Les oiseaux d'Algérie / Birds of Algeria. SEOF, Paris, 336.

Khaffou M (2014) Biologie et écologie du Tadorne casarca *Tadorna ferruginea* (Pallas, 1764) dans la Zone Humide d'Aguelmam Sidi Ali (Site Ramsar – Moyen Atlas – Maroc) en vue d'une Gestion Durable du Site. Thèse de doctorat, Université Moulay Ismail, Maroc. [In French]

Gelinaud G (1997) Ecologie et démographie d'une espèce en expansion: le Tadorne de Belon *Tadorna tadorna* en France. Thèse Université de Rennes 1.

Kershaw M, Cranswick PA (2003) Numbers of wintering waterbirds in Great Britain, 1994/1995–1998/1999: Wildfowl and selected waterbirds. Biological Conservation, 111: 91-104. https://doi.org/10.1016/S0006-3207(02)00253-7

Losito MP, Mirarchi E, Baldassarre GA (1989) New techniques for timing activity studies of avian flocks in view-restricted habitats. Journal of Field Ornithology, 60 (3): 388-396.

Mackinnon J, Phillipps K, He FQ (2000) A field guide to the birds of China. Hunan Education Publishing House, Changsha.

Merzoug SE, Amor Abda W, Belhamra M, Houhamdi M (2014) Eco-ethology of the wintering ferruginous duck *Aythya nyroca* (Anatidae) in Garaet Hadj Tahar (Guerbes-Sanhadja, Northeast of Algeria). Zoology and Ecology, 4: 297-304. https://doi.org/10.1080/21658005.2014.953800

North American Rare Bird Alert (NARBA) (www.narba.org) Archived from the original on January 18, 2011.

Patterson IJ (1982) The shelduck *Tadorna tadorna* – a study in behavioural ecology. Cambridge University Press, Cambridge. 276 p.

Tamisier A, Dehorter O (1999) Camargue, Canards et Foulques. Fonctionnement d'un prestigieux quartier d'hiver. Centre Ornithologique du Gard. Nîmes, 369. [In French]

Walmsley JG (1986) Wintering Shelduck *Tadorna tadorna* in the West Mediterranean. Supplemento Ricerche di Biologia della Selvaggina 10: 339-351.

Walmsley JG (1987) Le Tadorne de Belon *Tadorna tadorna* en Méditerranée occidentale. L'Oiseau et la Revue Française d´Ornithologie 57: 102-112.

Wetlands International (2002) Waterbird Population Estimates (3rd edition). Wetlands International Global Series No. 12, Wageningen, Netherlands.

Wetlands International (2004) Waterbird Population Estimates. Annual Review, Wetlands International, Wageningen, Netherlands.